

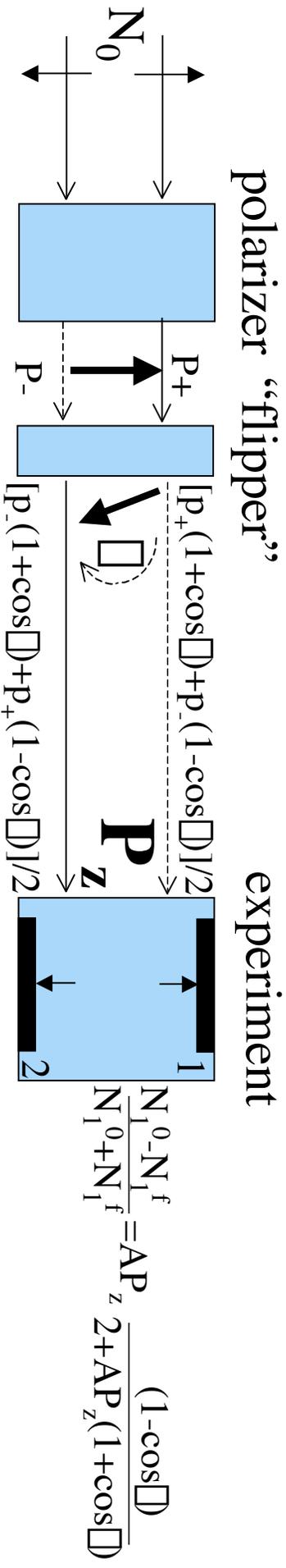
# Precision Polarimetry of Pulsed Cold Neutron Beams

Can we use npdgamma beam line to develop polarimetry for  
PULSED POLARIZED COLD NEUTRON BEAMS

?

# Precision Polarimetry of Pulsed Cold Neutron Beams

everything is a function of  $\phi, x, y, z, t$



We do TWO measurements

$$\phi = 0 \quad \text{and} \quad \phi \sim \pi$$

$$P_z^0 = (p_+ - p_-) \quad P_z^f = (p_+ - p_-) \cos\phi$$

or FOUR measurements (flip  $p_+/p_-$ )

BUT  $p_+$  and  $p_-$  change

# Notes:

$$\frac{N_1^0 - N_1^f}{N_1^0 + N_1^f} = A P_z \frac{(1 - \cos \Phi)}{2 + A P_z (1 + \cos \Phi)}$$

Flipper rotates spin with respect to **B** by  $\Phi$ .

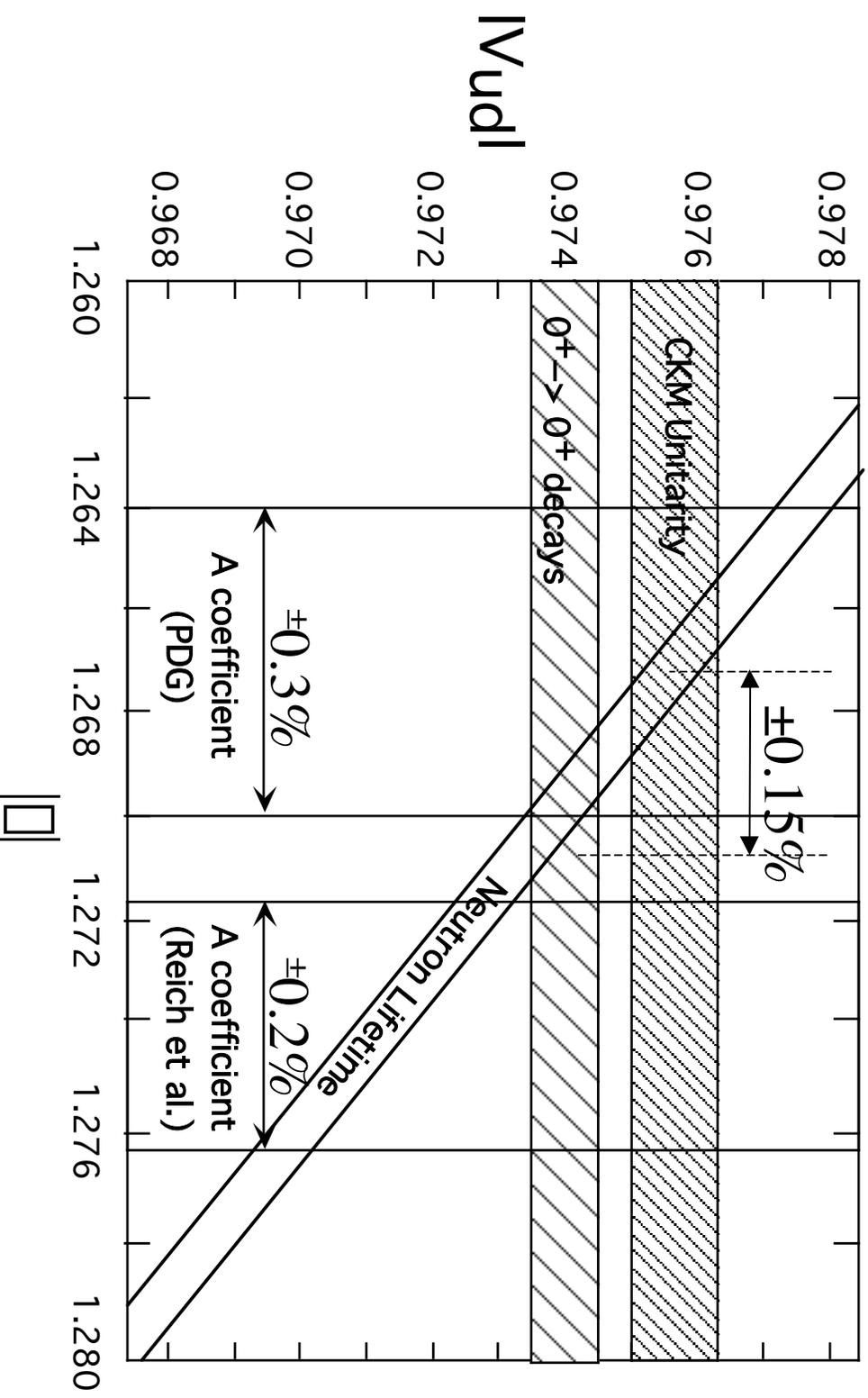
AFP flipper can be better ( $\Phi$  arbitrarily close to  $\pi$ ).

Free neutron spin propagates with predictable evolution  
(transverse/off diagonal components average over experiment)

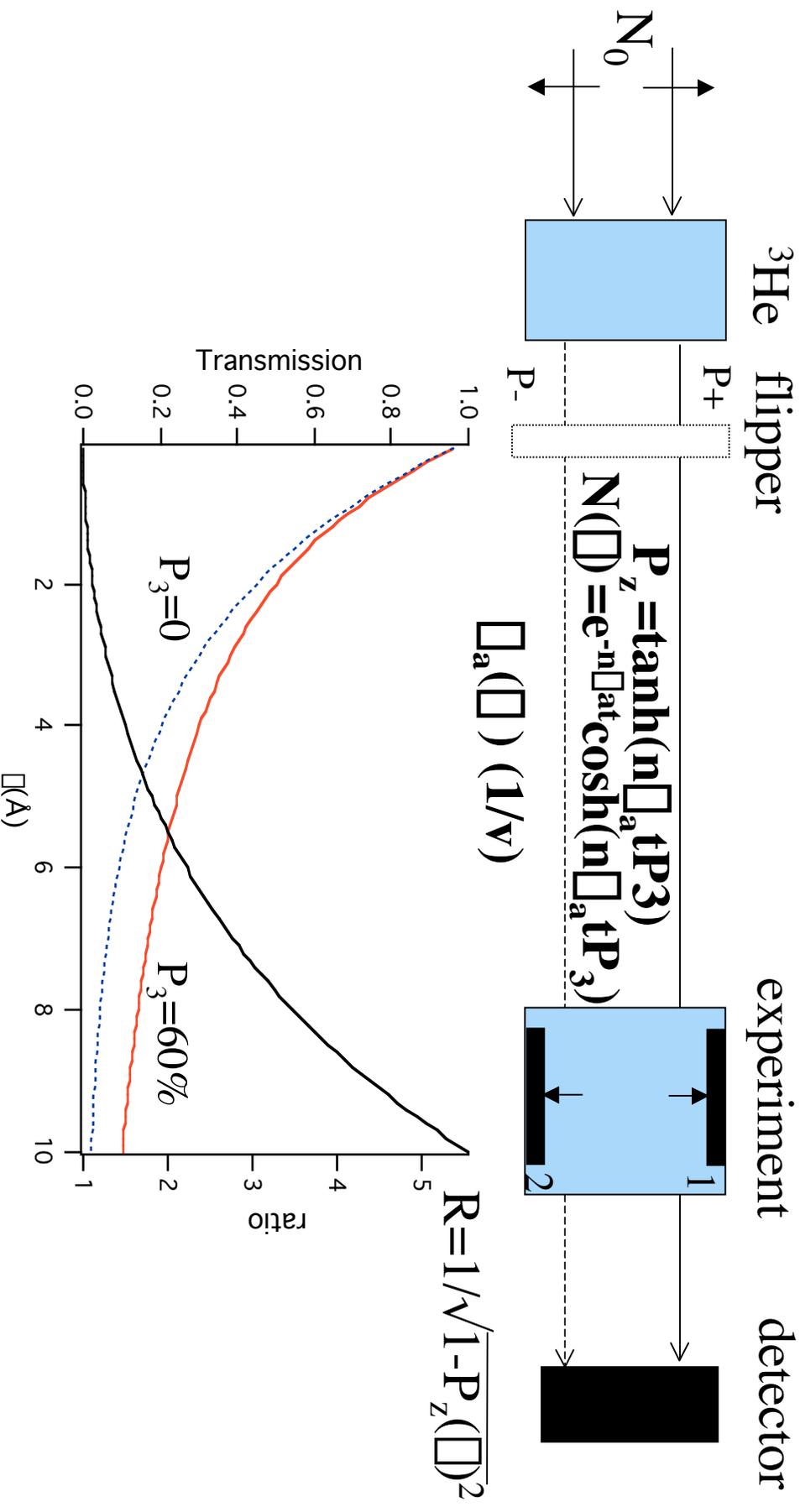
We need to know  $P_z(\Phi, x, y, z, t)$  and  $\Phi(\Phi, x, y, z, t)$   
(also  $\Phi(\Phi, x, y, z, t)$  if electron/gamma is not prompt)

# How Precise?

$<0.1\%$



# Coulter/Greene/Rich Transmission Method



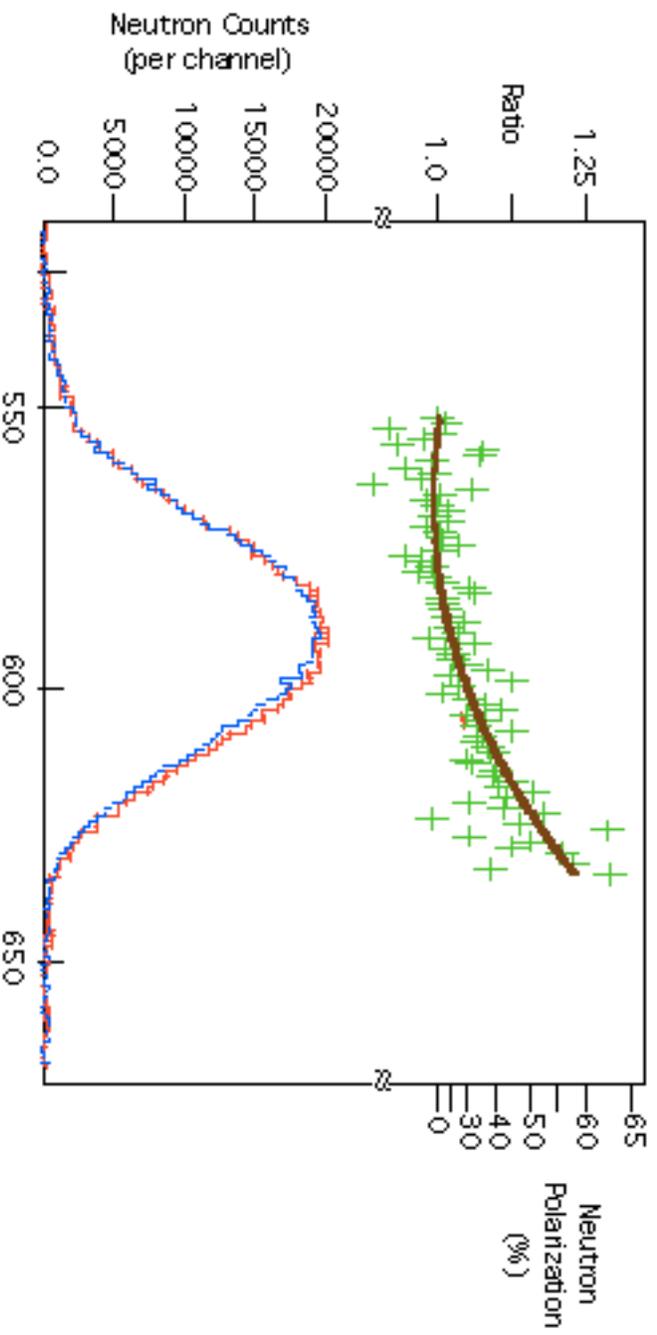
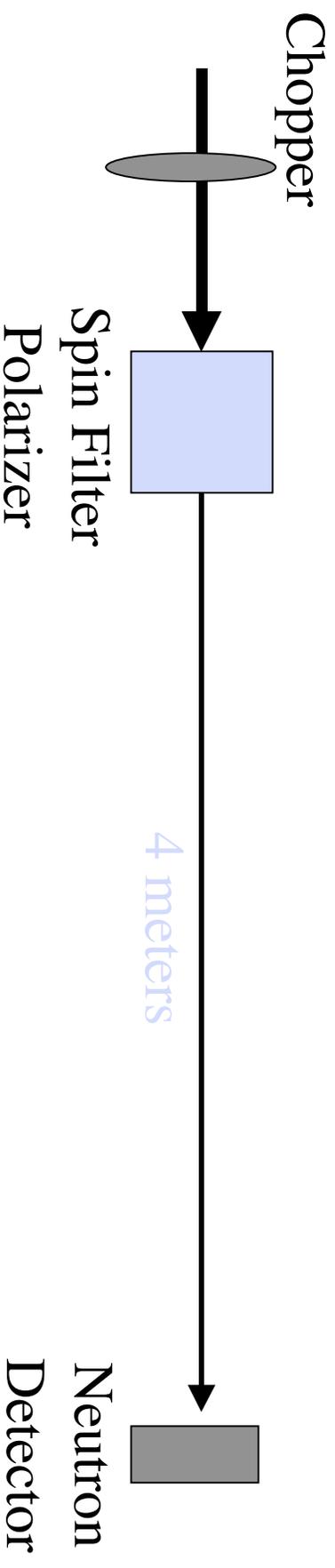
Does Experiment Change  $N(I)$  in a spin dependent way?

Is  $I_a$  completely  $1/v$  and spin dependent ( $I_t/I_s = 1.01 \pm 0.01$ )?

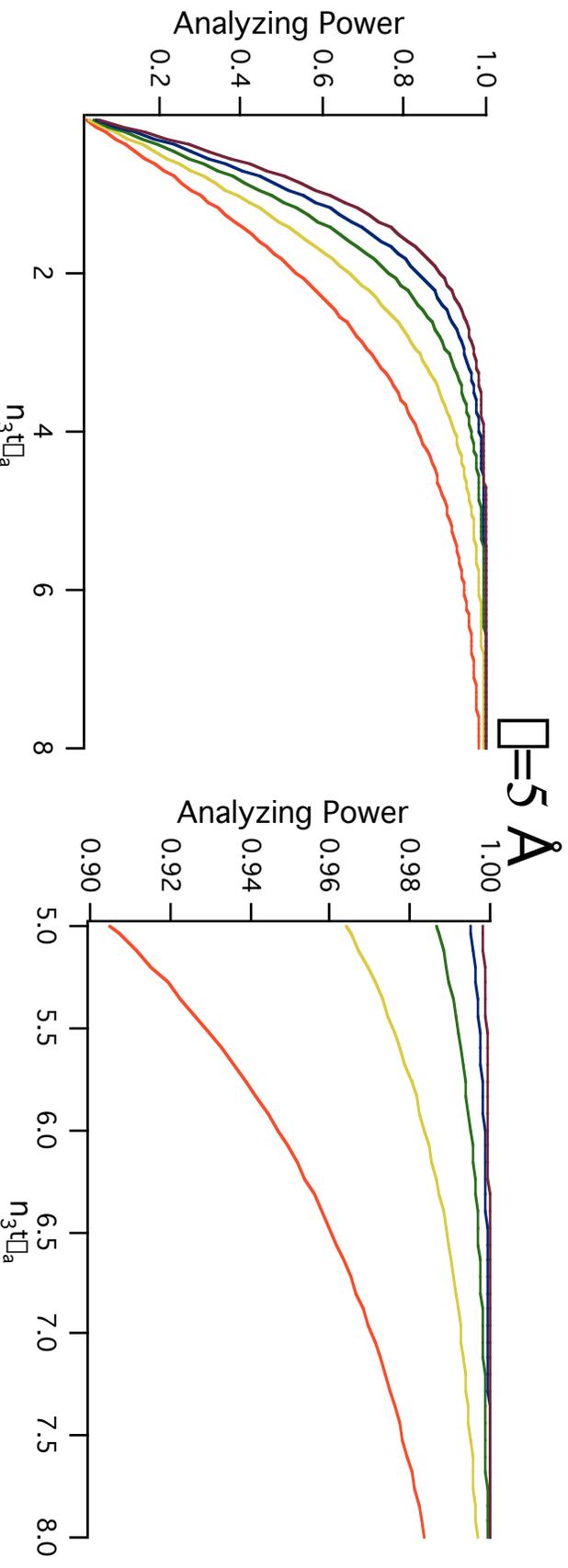
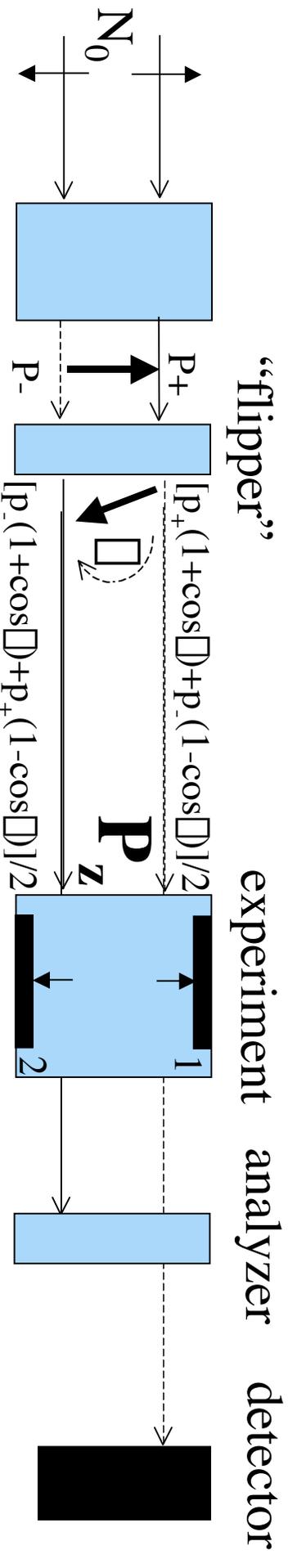
Doesn't characterize FLIPPER (BUT can reverse  $^3\text{He}$ )

# Thermal Neutron Polarization With $^3\text{He}$

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# Need an Analyzer

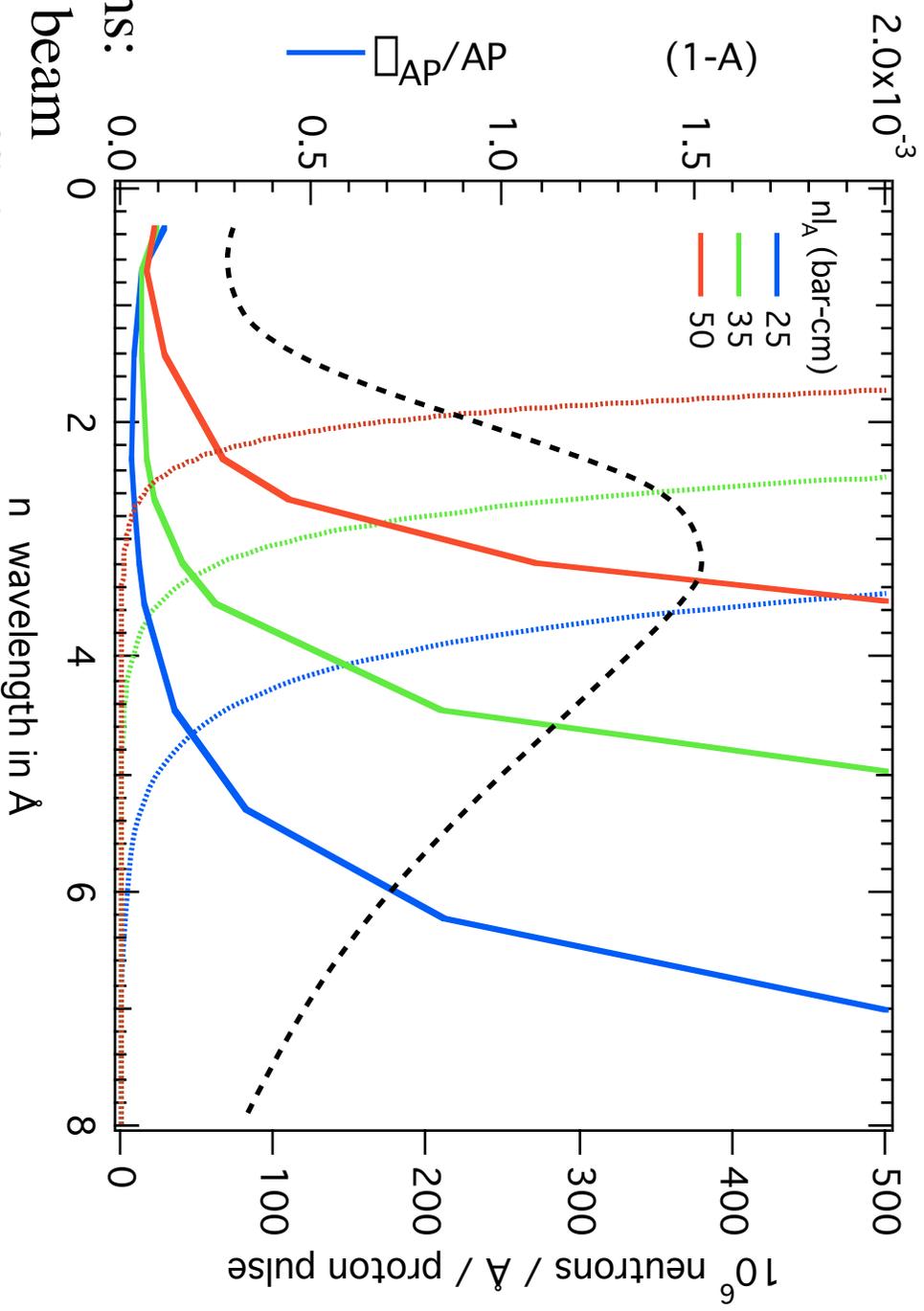


Opaque Analyzer: For  $n_3 t \square_a$  large enough (1-A) small enough-Zimmer

Can characterize Polarizer AND Flipper

Still worry about what experiment does to beam (spin dependent)

# Analyzer Precision



Assumptions:

npdgamma beam

100% detector efficiency

5 cm<sup>2</sup>

1 Å bins

50% <sup>3</sup>He polarization

# We Propose:

Use npdgamma beam line to

- 1) Push transmission method to limit  
Statistics  
Systematics  
 $P_3$  changes  
 $P_3=0$  measurement  
Beam monitor  
Background/pileup/etc,  
 $1/v$
- 2) Use opaque  $^3\text{He}$  analyzer -- different  $n_3 t$   
Statistics  
Systematics
- 3) Combine the two  
HOW?